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Vibration Damping of Mechanical Seals

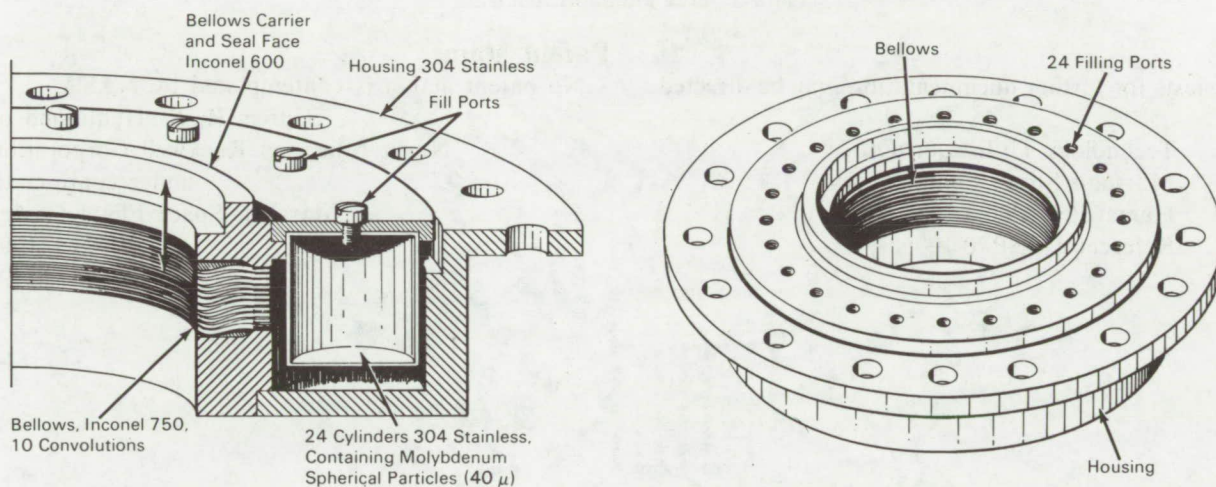


Figure 1. Particle Damped Seal

The problem:

Mechanical seals used in turbopump machinery are subjected to axial shaft displacements caused by elastic deformations, fluid pressure pulsations, and vibrations. These conditions cause seal leakage and reduce the life and reliability of the mechanical seals.

The solution:

A bellows seal filled with spherical powder (40μ size) which reacts to vibration inputs by absorbing displacement energy through inertia and friction of the particle masses acting on the inside surface of the cylinders.

How it's done:

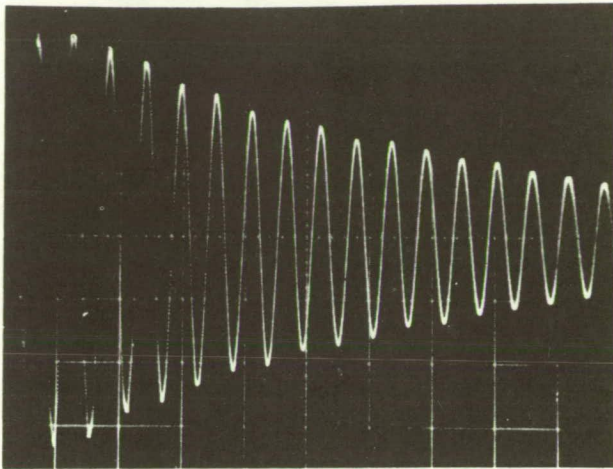
The particle damped seal (Figure 1) consists of a conventional bellows seal design which uses a sta-

tionary bellows welded to a sealing face and loaded against an adjacent rotating sealing surface. In addition, a series of 24 cylinders are welded to a radial extension of the sealing surface placing the cylinders at the OD of the bellows. The cylinders are filled to an effective level with molybdenum spherical powder.

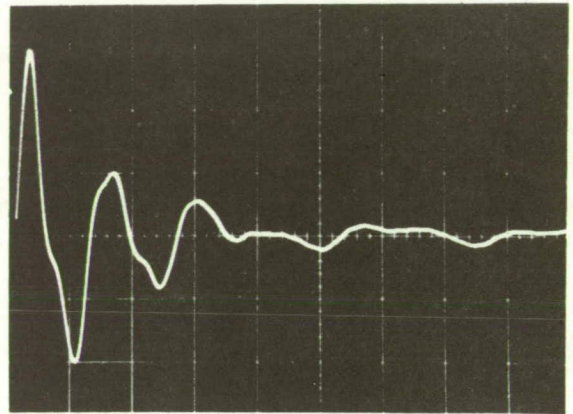
Vibration data (Figure 2) taken during testing of the particle damped seal indicate damping increases with decreasing particle diameter and with an increasing quantity of particles. Apparently, the damping is unaffected by the method of loading the particles.

The prime advantages over conventional vibration damping devices and other concepts are simplicity of design and a potential increase in reliability. Effective damping can be obtained over a wide range of temperatures from -300 to $+1000^{\circ}\text{F}$.

(continued overleaf)



Empty



Full

Figure 2. Free Vibration Test Data

Note:

Requests for further documentation may be directed to:

Technology Utilization Officer
Marshall Space Flight Center
Huntsville, Alabama, 35812
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Patent status:

No patent action is contemplated by NASA.

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